JLECON

Volume / Cilt: 11, Issue / Sayı: 4, 2024, pp.165-174
E - ISSN: 2148-4139
URL: https://www.journals.gen.tr/jlecon
DOI: https://doi.org/10.15637/jlecon.2560

Received / Geliş: 27.08.2024
Acccepted / Kabul: 17.10.2024

RESEARCH ARTICLE / ARAŞTIRMA MAKALESİ

Analysis of factors influencing banks' profitability using panel data models

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Abstract

The banking sector, as one of the fundamental pillars of the financial industry, being in a healthy condition is of paramount importance not only from an individual perspective but also for firms and governmental administrations. Banks support sustainable economic conditions in all economies by facilitating investments and channeling idle funds into the economy. In this study, the analysis of micro and macro-level variables affecting the return on assets and return on equity of 24 banks operating in the Turkish banking sector from 2016 to 2023 has been investigated using panel data models. According to the results obtained from the analysis, it was found that there is a positive and significant relationship between return on assets and capital adequacy ratio, a negative and significant relationship with non-performing loans, a positive and significant relationship with BIST100 (Borsa Istanbul 100 Index), and a negative and significant relationship with bond yields. Additionally, a negative and significant relationship was found between return on equity and non-performing loans, and a positive and significant relationship with the BIST100 index.

Keywords: Finance, Banking, Profitability, Panel Data Analysis

Jel codes: G21, G32

Citation/Atıf: ERDOĞAN, B. (2024). Analysis of factors influencing banks' profitability using panel data models. *Journal of Life Economics*. 11(4): 165-174, DOI: 10.15637/jlecon.2560

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1. INTRODUCTION

The financial sector performs crucial activities in creating a strong and stable economy. Particularly in today's commercial environment, it assumes significant roles beyond mere management of monetary relations, such as ensuring the healthy functioning of markets and allocating resources efficiently across time and space (Demirgüç Kunt and Levine, 2008:4).

The financial development of countries relies on the effective and efficient operation of markets, financial instruments, and financial intermediaries. In this regard, the sectors comprising the financial sector, including banks, insurance companies, leasing, factoring, forfaiting, and securities and real estate investment trusts, have significant responsibilities. Particularly since the twenty-first century, with the pervasive influence of information and communication technologies, rapid changes are observed in both social life and markets (Weqar et al., 2021:1135).

The banking sector, one of the most important actors in the financial sector, ensures the sustainability of economic life (Takan and Boyacıoğlu, 2011), facilitates economic growth, and plays a vital role in the global economy by providing essential financial services (Sharma et al., 2024:90).

In the 1990s, political crises, the Asian economic crisis, the Marmara earthquake, and ultimately a major economic crisis led to the culmination of economic difficulties. During this deep crisis period, it is observed that 24 banks in the sector went bankrupt and ceased their operations. In the early 2000s, many structural and fundamental new decisions were taken in the Turkish banking sector to aim for a reliable, transparent, and healthy structure. Under the implemented new economic and legal regulations, the sector, which continues its activities, currently demonstrates a positive outlook among developing economies with 58 banks, a total asset size of 22 trillion TL, 14 billion TL in deposits, and 11 billion TL in loan volume (TBB Official Statistics).

This study aims to analyze the profitability of 24 banks operating in the Turkish banking sector using annual data from the years 2016 to 2023. The study includes two dependent variables: Return on Assets (ROA) and Return on Equity (ROE). Additionally, nine independent variables are included in the study: capital adequacy ratio, total loans/total deposits ratio, fixed assets/total assets ratio, liquid assets/total assets ratio, non-performing loans, BIST100 index, USD exchange rate, EUR exchange rate, and bond yields.

The ROA is highly significant as it indicates how much profit a bank can generate with its assets and reflects the bank's efficiency (Dietrich and Wanzenried, 2014:339; Curak et al., 2012:411). On the other hand, the ROE represents the profitability of the capital invested in the business by shareholders (Khrawish et al., 2011: 49; Demirel et al., 2013:105).

The study will include summary statistics, unit root tests, appropriate model selection analyses, tests for deviation from assumptions, and predictive analyses. The results obtained from the study are crucial for examining banks, which are among the most significant players in the economy. The primary aim of the obtained results is to provide insights to firms operating in the sector and especially to investors. Additionally, the study is expected to offer a new perspective by covering the pandemic period and using macroeconomic variables (BIST100, USD, EUR, Bonds) that have not been previously utilized in relevant discussions.

The study aims to provide the most accurate and generalizable results about the sector, as it encompasses nearly all deposit banks operating within it. However, due to the inclusion of the pandemic period in the study timeframe, it is likely to yield different results compared to previous studies - particularly in the short term. Future studies may obtain different results by comparing different periods with each other.

2. LITERATURE REVIEW

While there is a plethora of literature on bank profitability, it is observed that different variables, periods, and examined banks lead to diverse results. Summarizing some of the studies conducted in the relevant field is possible as follows:

Athanasoglou et al. (2008) aimed to analyze the factors influencing profitability in the Greek banking sector from 1985 to 2001. The results indicated that capital was a significant determinant of profitability, and exposure to high credit risk negatively affected profitability.

Dağıdır (2010) conducted an analysis of the factors influencing bank profitability using monthly data from 2003 to 2008. According to the study results, there was a negative relationship between the industrial production index and profitability.

Doğru (2011) aimed to analyze the factors affecting net interest margin, return on assets, and return on equity. The study, conducted using monthly data from 2005 to 2010, found a positive relationship between bank assets and personnel expenses with profitability.

Ramadan et al. (2011) conducted an analysis of the factors affecting the profitability of 10 banks operating in Jordan between 2001 and 2010. The results indicated that variables such as capital adequacy ratio and loan volume had significant impacts on profitability.

Taşkın (2011) aimed to analyze the factors affecting the profitability of banks between 1995 and 2009. The results of the study indicated a positive relationship between industrial production index and profitability, whereasa negative relationship was observed between capital adequacy ratio and the ratio of non-performing loans to total loans.

Gülhan and Uzunlar (2012) utilized panel data analysis to examine the factors influencing the profitability of banks between 1990 and 2008. The study results indicated that variables such as capital adequacy ratio, operating expenses, liquidity position, bank size, and non-performing loans were effective in determining profitability.

Menicucci and Paolucci (2016) conducted a study aiming to analyze bank-specific factors influencing profitability in the European banking sector. The study results indicated a significant relationship between bank size, capital adequacy ratio, and profitability.

In the study by Reis et al. (2016), the variables affecting the return on assets and net interest margin of 16 banks listed on the Borsa Istanbul (BIST) between 2009 and 2013 were analyzed. The results indicated a significant relationship between leverage ratio, loan-to-deposit ratio, market capitalization, gross domestic product (GDP), and bank profitability.

In the study conducted by Sarıtaş et al. (2016), factors influencing the profitability of commercial banks between 2002 and 2013 were analyzed. The results indicated a negative relationship between profitability and non-performing loans-to-total loans ratio, and a positive relationship between total income-to-total expenses ratio.

In the study conducted by Adelopo et al. (2018), the analysis encompassed the factors affecting the profitability of banks during the global financial crisis. The results indicated that bank size, liquidity, and cost management had impacts on profitability.

In the study conducted by Aydın (2019), an analysis of the factors influencing banks' profitability between 2005 and 2015 was performed. The study results indicated that variables such as credit risk, operating expenses, bank capital, and inflation rate had significant impacts on profitability.

In the study conducted by Çelik and Kaya (2019), an analysis of the factors influencing banks' profitability between 2009 and 2017 was performed. The study results indicated that the capital adequacy ratio had a positive effect on profitability, whereas personnel expenses had a negative effect.

In the study by Türkdönmez and Babuşcu (2019), an analysis of the factors influencing the profitability of 11 banks operating in Turkey between 2010 and 2017 was conducted. The results indicated a significant positive relationship between inflation, average deposit interest rates, and GDP.

In the study by Le and Ngo (2020), conducted between 2002 and 2016 across 23 countries, the determinants of bank profitability were examined. The results suggested that the

development of capital markets had a significant impact on bank profitability.

In the study conducted by Saif-Alyousfi (2022), the analysis aimed to identify the factors influencing bank profitability in Asian countries between 1995 and 2017. The results indicated that deposits, credit risk, and credit growth had positive impacts on profitability, whereas non-performing loans had a negative effect.

3. METHODOLOGY

3.1. Study Data

In the study, a total of 24 deposit banks operating in the Turkish banking sector, for which complete data could be accessed, were included. Table 1 below presents the banks used in the study along with their basic information.

The study includes two dependent variables: return on assets and return on equity. The independent variables included in the study are capital adequacy ratio, total loans/total deposits ratio, fixed assets/total assets ratio, liquid assets/total assets ratio, non-performing loans, BIST100 index, USD exchange rate, EUR exchange rate, and 2-year bond yield. The data were obtained from the BRSA (Banking Regulation and Supervision Agency) and the Investing platform.

3.2. Research Methodology

In order to identify the factors affecting the ROA and ROE of 24 deposit banks operating in the Turkish banking sector, panel data analysis was conducted. Two different panel data models were constructed in the study, and these models are expressed in Equations 1 and 2.

Table 1. Banks Included in the Study

Banks	
Türkiye Halk Bankası A.Ş.	Arap Türk Bankası A.Ş.
Türkiye Vakıflar Bankası T.A.O.	Burgan Bank A.Ş.
Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	Citibank A.Ş.
Akbank T.A.Ş.	Denizbank A.Ş.
Anadolubank A.Ş.	Deutsche Bank A.Ş.
Fibabanka A.Ş.	HSBC Bank A.Ş.
Şekerbank T.A.Ş.	ICBC Turkey Bank A.Ş.
Turkish Bank A.Ş.	ING Bank A.Ş.
Türk Ekonomi Bankası A.Ş.	Odea Bank A.Ş.
Türkiye İş Bankası A.Ş.	QNB Finansbank A.Ş.
Yapı ve Kredi Bankası A.Ş.	Turkland Bank A.Ş.
Alternatifbank A.Ş.	Türkiye Garanti Bankası A.Ş.

Table 2. Variables Used in the Study

Variables	**Abbreviation**	**Formulation**	**Source**
Return on Assets	ROA	Net Profit/Total Assets	
Return on Equity	ROE	Net Profit/Equities	
Capital Adequecy Ratio	CAR	Equities/Total Assets	
Total Loans /Total Deposits	TLTD		
Fixed Assets/Total Assets	FATA		TBB
Liquid Assets/Total Assets	LATA		
Non-performing Loans	NPL	Non-performing Loans /Total Loans	
BIST100	BIST		Investing
USD/TL	USD		
EUR/TL	EUR		
Bond	BOND	2-year bond yield	

Source: (Doğru, 2011; Ikhwal, 2016; Aydın, 2019; Güvemli et al., 2021)

$$ROA_{it} = \beta_0 + \beta_1 MED_t + \beta_2 BDD_{it} + \varepsilon_{it} \quad (1)$$

$$ROE_{it} = \beta_0 + \beta_1 MEV_t + \beta_2 BLV_{it} + \varepsilon_{it} \quad (2)$$

The subscript i ranging from 1 to 24 represents the deposit banks, and the subscript t ranging from 2016 to 2023 represents the time span of the data. ROA_{it} represents the return on assets of bank i at time t, while ROE_{it} represents the return on equity of bank i at time t. β_0 denotes the constant parameter of the model, MEV_t represents the macroeconomic variables in the model, BLV_{it} represents the bank-level variables, and ε_{it} represents the random (stochastic) error term.

The results obtained using the Stata 15 software in the study are presented in tables below.

4. FINDINGS

The summary statistics of the variables used in the study are presented in Table 3. According to Table 3, the mean value of ROA of banks during the examined period was 1.69, a result similar to the sector mean value of 1.7.

The mean value of ROE was found to be 15.30, exhibiting similarity to the sector mean value of 16.8. However, there is a significant difference between the minimum and maximum values. The CAR was calculated as 19.37, slightly higher than the sector mean value of 17.8.

During the period under review, non-performing loans averaged 5.24%, the BIST100 index stood at 2655 points, the exchange rate for the USD was

Table 3. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	192	1.697206	2.047486	-11.90485	9.797699
ROE	192	15.30607	20.50745	-176.6806	60.45225
CAR	192	19.37739	4.750627	13.07662	38.83287
TLTD	192	94.55958	27.75511	25.84355	227.1639
FATA	192	3.444987	2.370733	-1.513776	10.48448
LATA	192	24.16124	11.24129	8.3644275	62.95125
NPL	192	5.249889	6.31169	-1.700753	48.5879
BIST100	192	2655.031	2542.018	862.96	8496.66
USD	192	11.06096	8.818517	3.7555	30.3648
EUR	192	12.28951	9.402404	4.0725	32.7888
BOND	192	16.9975	9.213007	9.98	39.43

Table 4. CIPS Unit Root Test Results

Variables	**Statistic Value**
ROA	-3.524***
ROE	-3.511***
CAR	-4.543***
TLTD	-4.554***
FATA	-3.680***
LATA	-4.218***
NPL	-4.534***
BIST100	2.610***
USD	2.610***
EUR	2.610***
BOND	2.610***

Table 5. Appropriate Model Selection Results

Tests	**Results**	**Effect/Result (Model 1)**	**Results**	**Effect/Result (Model 2)**
Unit Effect (F Test)	5.09 (0.0000)	Unit effect exists	1.77 0.0219	Unit effect exists
Time Effect (Breusch and Pagan LM Test)	7.11 (0.0000)	Time effect exists	9.14 0.0000	Time effect exists
Hausman Test	4.16 (0.8420)	Random effects	9.36 0.0249	Fixed effects

11 TL, the exchange rate for the Euro was 12.28 TL, and the average bond yield was 16.99%. It is observed that the CAR averaged 19%, exceeding Basel criteria.

The stationary nature of the variables included in the study was analyzed using the Pesaran (2007) second-generation CIPS panel unit root test. The CIPS unit root test is frequently preferred in the literature due to its feature of considering cross-sectional dependence (CSD). According to the results of the CIPS unit root test presented in Table 4, it is understood that all variables are stationary at the level.

In static panel data analysis, three different estimation models can be used: Pooled Ordinary Least Squares (POLS), Random Effects (REM), and Fixed Effects (FEM). certain tests need to be conducted to determine which method to be employed. Table 5 presents the performed tests for choosing the appropriate model. The F-test allows choosing between POLS and FE models, the Breusch-Pagan LM (1980) test allows choosing between POLS and REM, and the Hausman (1978) test enables choosing between FEM and REM models (Tatoğlu 2020: 176). According to the analysis results presented in Table 5, the REM is appropriate for Model 1, whereas the FEM is suitable for Model 2.

According to the selected appropriate model, tests were conducted separately for autocorrelation, heteroscedasticity, and CSD for the two identified models. The results are presented in Tables 6 and 7.

Table 6 presents the results for the ROA model, where the issue of heteroscedasticity was examined using the Levene-Brown Forsythe test, autocorrelation was assessed performing Bhargava et al.'s Durbin Watson test and Baltagi-

Table 6. Results of Assumption Violation Tests (1)

Test Types	Prob.	Issues
Levene-Brown Forsythe	0.0000*	
	0.0000**	Exists
	0.0000***	
Bhargava etc. DW	1.6715	Exists
Baltagi-Whu LBI	1.8375	Exists
Friedman's	0.3848	Does not exist

Table 7. Results of Assumption Violation Tests (2)

Test Types	Prob.	Issues
Modified Wald	0.0000	Exists
Bhargava etc. DW	1.4237	Exists
Baltagi-Whu LBI	2.0010	Does not exist
Pesaran	0.0000	Exists

Table 8. Research Results of Arellano, Froot, Rogers Resilient Estimator

ROA	Coefficient	Std. Error	Z- statistic	Prob. Value
CAR	**.1284047**	.0370512	3.47	**0.001*** **
TLTD	.0089934	.0062952	1.43	0.153
FATA	.0275834	.0709733	0.39	0.698
LATA	.0178632	.0150219	1.19	0.234
NPL	**-.1435769**	.009962	-14.41	**0.000*** **
BIST	**.0002451**	.000081	3.03	**0.002*** **
USD	.1307567	.3615048	0.36	0.718
EUR	-.0737998	.3546502	-0.21	0.835
BOND	**-.05379**	.0103626	-5.19	**0.000*** **
_cons	-1.689988	1.107483	-1.53	0.127
sigma_u	.89089327			
sigma_e	-.05379			
rho	.38553973			

WHU LBI test, and CSD was analyzed using the Friedman's test under the REM.

According to the results presented in Table 7, for the ROE model within the FEM framework, the issue of heteroscedasticity was examined using the Modified Wald test (Greene, 2003:323), autocorrelation issue was investigated through the Bhargava et al., Durbin Watson test (1982), and Baltagi-WHU LBI (1999) test, and the issue of CSD was explored by performing the Pesaran test.

According to the results of the assumption violation tests for the REM of the ROA model, heteroscedasticity and autocorrelation issues were identified, with no CSD observed. However, for the FEM of the ROE model, assumption violation test results indicate the presence of issues related to heteroscedasticity, autocorrelation, and CSD.

A positive and significant relationship is observed between the BIST100 index and the ROA, albeit at low levels. This result suggests that during periods of increased BIST returns, investors may prefer bank stocks or that additional capital entering the economy through stock markets positively impacts the financial sector, thereby enhancing the ROA.

Lastly, a negative and significant relationship is identified between bond yields and ROA. This finding suggests that during periods of increased bond yields, investors may withdraw their funds from banks or refrain from investing in banks, thereby negatively impacting the ROA.

In the ROE model, the robust standard errors estimator proposed by SE Driscoll-Kraay (1998), resilient to identified issues, was utilized. The obtained results are presented in Table 9.

Upon examining the results presented in Table 9, it was observed that the variable of non-performing loans has a negative and significant effect on the ROE. This outcome can be interpreted as indicating a decrease in the ROE of banks experiencing difficulties in collecting their loans.

It was found that there exists a positive and significant relationship between the BIST100 index and ROE. Although this relationship occurs at very low levels, it can be expressed as the increases observed in the BIST100 index being reflected in the financial sector through firms, thereby impacting bank profits.

5. CONCLUSION

The twenty-first century has brought about many changes in social and commercial life. Particularly, consumers' expectations have begun to change rapidly, product variety has reached its peak, and as a result, competition among companies has reached its highest level. In a period where economic life has changed so much, financial markets and institutions have been greatly affected by this change. The changing understanding of trade has exposed institutions to innovations in order to keep up with this situation and meet expectations.

Today's financial world has evolved into a modern form, moving far away from the traditional understanding of trade, largely due to the rapid advancement of information and communication technologies. All institutions comprising the financial sector have adapted to these changing and evolving conditions, providing many activities swiftly and securely to facilitate human life and sustain economic activities. Banks, which play a pivotal role as the locomotive of the financial sector in both

Table 9. Research Results of Driscoll-Kraay Resilient Estimator

ROE	Coefficient	Std. Error	t-statistic	Prob. Value
CAR	.3035728	.3160934	0.96	0.347
TLTD	.0226619	.0427083	0.53	0.601
FATA	.2580616	.4500919	0.57	0.572
LATA	.0831899	.1006626	0.63	0.533
NPL	**-1.667855**	.1314661	-16.57	**0.000*****
BIST	**.0049483**	.0028466	1.74	**0.096**

developed and developing economies, have taken on the responsibility not only of channeling idle funds into the economy and supporting investments but also of serving as significant advisors in ensuring economic functionality.

This study aims to analyze the bank-specific and macroeconomic variables affecting the profitability of 24 banks operating in the Turkish banking sector. The results of the study indicate significant relationships between the ROA and capital adequacy ratio, non-performing loans, and the BIST100 index. Additionally, a significant relationship between the ROE and non-performing loans, as well as the BIST100 index, has been identified.

The model analysis was conducted using the TE Arellano (1987), Froot (1989), Rogers (1993) robust estimator, which is resistant to the issues identified in the ROA model. The obtained results are presented in Table 8.

The results indicate that as banks' capital increases, their ROA also increases. This finding is consistent with the results of Çelik and Kaya (2019), Hacıevliyagil and Şit (2019), Erbir (2020), and Coşkuner and Rençber (2022). However, it differs from the findings of Taş and Duramaz (2018).

The study finds that an increase in banks' non-performing loans negatively affects their ROA. This result is consistent with the findings of Salihoğlu (2020).

When considering all these results together, it is evident that the profitability of banks is influenced not only by microeconomic variables but also by macroeconomic variables during the study period. Particularly, the variable of non-performing loans, which is a micro variable, affects both the ROA and ROE. This finding is consistent with previous studies in the literature. In such a context where profitability is significantly affected, it can be crucial for banks to adopt a risk-focused lending policy and exercise caution while extending credit. Reducing non-performing loans to the lowest level or disposing of them through asset management companies is very important in terms of increasing profitability.

On the other hand, the positive relationship between the BIST100 index and profitability implies the importance of supporting investors and firms to facilitate investment, both through credit provision and other forms of assistance. This result underscores the significance of banks maintaining interest rates at reasonable levels to attract investors, ultimately leading to greater profitability in the long run. In addition, supporting the markets by investors investing in equities can be beneficial for the profitability of the banking sector.

The study is particularly significant for encompassing the COVID-19 pandemic, which has deeply impacted all countries. In this regard, it stands apart from existing research, and furthermore, the inclusion of all deposit banks in the study allows for the possibility of reaching the most accurate results for the sector.

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Notes

1- Adabank A.Ş., Birleşik Fon Bankası A.Ş. and Türk Ticaret Bankası, which are under the SDIF (Savings Deposit Insurance Fund), and Bank of China Turkey A.Ş., MUFG Bank Turkey A.Ş. and Rabobank A.Ş., whose data are missing, are not included in the study.